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Science and Engineering Opportunities at Los Alamos National Laboratory

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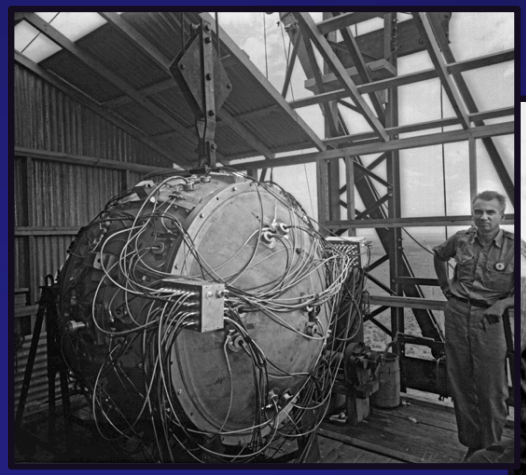
Los Alamos
NATIONAL LABORATORY
EST. 1943

April 11, 2019

At Los Alamos, we deliver science and technology to protect our nation and promote world stability

- Our mission began by applying science and technology to address an international crisis
- Today, we are responsible for the design, engineering, and sustainment of the majority of the United States' nuclear weapons capabilities
- We also work to assess & reduce global nuclear danger
- We offer unparalleled career opportunities in science, engineering, manufacturing, business, and more



We invest in robust and leading-edge science & technology programs to enable our mission

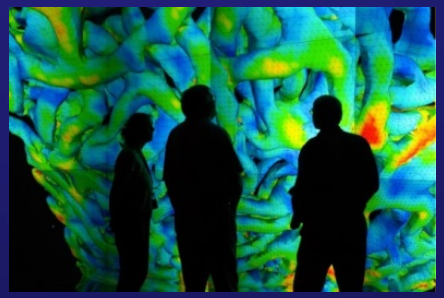
- The US stopped full-scale testing of nuclear weapons in 1992, but wants to maintain nuclear weapons capabilities indefinitely
- *Stockpile stewardship* requires physics and engineering insight enabled by experiment, computation, and theory
- Staying on the forefront of key science & technology areas is critical to US national security

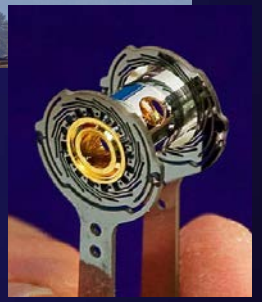
Theory

$$\frac{\partial \rho}{\partial t} + \nabla \cdot \rho \boldsymbol{v} = 0,$$
$$\frac{\partial}{\partial t}(\rho \boldsymbol{v}) + \nabla \cdot \rho \boldsymbol{v}\boldsymbol{v} + \nabla P_{\mathrm{tot}} = 0,$$
$$\frac{\partial}{\partial t}(\rho E_{\mathrm{tot}}) + \nabla \cdot [(\rho E + P_{\mathrm{tot}})\,\boldsymbol{v}] = 0,$$
$$\frac{\partial}{\partial t}(\rho e_{\mathrm{ion}}) + \nabla \cdot (\rho e_{\mathrm{ion}} \boldsymbol{v}) + P_{\mathrm{ion}} \nabla \cdot \boldsymbol{v} = 0,$$
$$\frac{\partial}{\partial t}(\rho e_{\mathrm{ele}}) + \nabla \cdot (\rho e_{\mathrm{ele}} \boldsymbol{v}) + P_{\mathrm{ele}} \nabla \cdot \boldsymbol{v} = 0,$$
$$\frac{\partial}{\partial t}(\rho e_{\mathrm{rad}}) + \nabla \cdot (\rho e_{\mathrm{rad}} \boldsymbol{v}) + P_{\mathrm{rad}} \nabla \cdot \boldsymbol{v} = 0,$$

$$G(\rho, T) = G_0(\rho)\left(1 - \alpha \frac{T}{T_m(\rho)}\right)$$

Simulation & Computing





Experiments

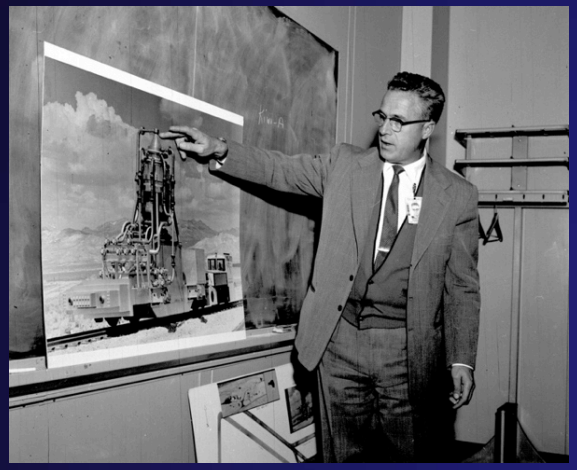
Diverse teams of 12,000 employees at Los Alamos work collaboratively to solve national security challenges

- 4000 Scientists and Engineers
  - 2200 PhD-level
  - 145 R&D100 awards,
    34 EO Lawrence awards,
    9 Presidential Early Career awards
- 400 Postdoctoral researchers
- 1500 summer students
- $2.8 Billion budget
- 36 square miles of facilities

Materials & Physical Data Group

Physics Verification & Analysis Group

Los Alamos has many connections to Purdue; here are three examples



Raemer Schreiber
PhD Physics
Purdue, 1941

Scientist and manager
1943-1974

Robert Webster
PhD Nuclear Engineering
Purdue, 1988
MS Nuclear Engineering
Purdue, 1986

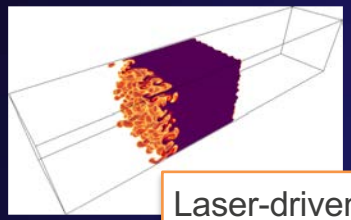
Deputy Director for Weapons

David Culp
BS Mathematics
Purdue, 2008

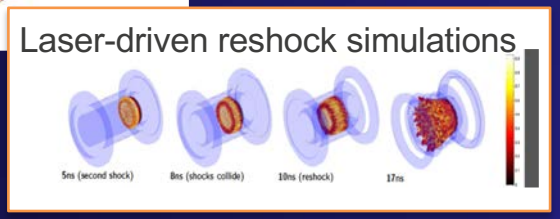
Scientist, Computational Physics

Opportunities in computational science & engineering

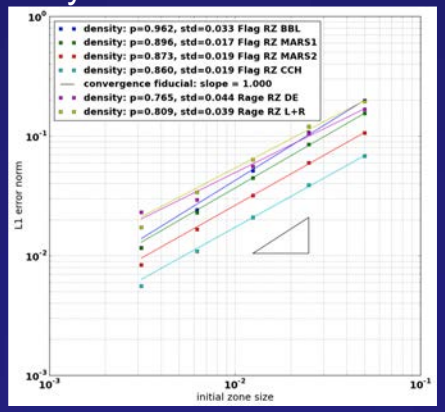
Richtmyer-Meshkov instability



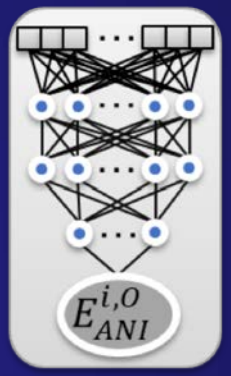
Laser-driven reshock simulations



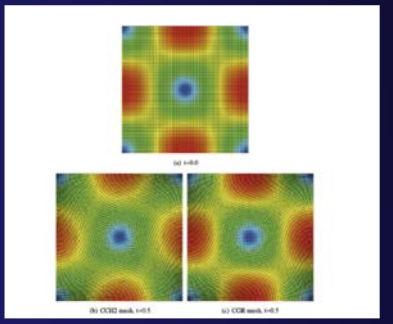
Verification, Validation & Uncertainty Quantification



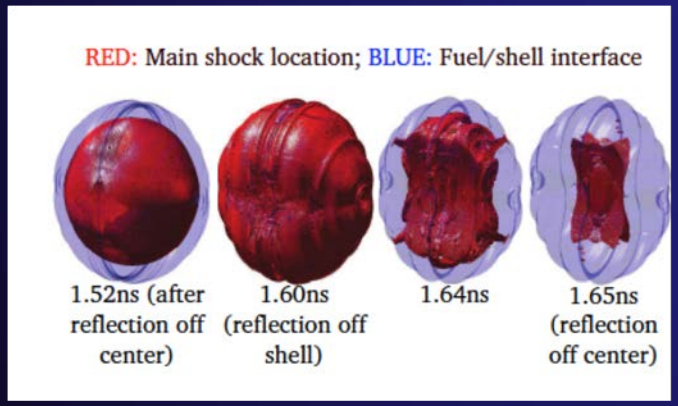
Machine Learning for inter-atomic potential calculations



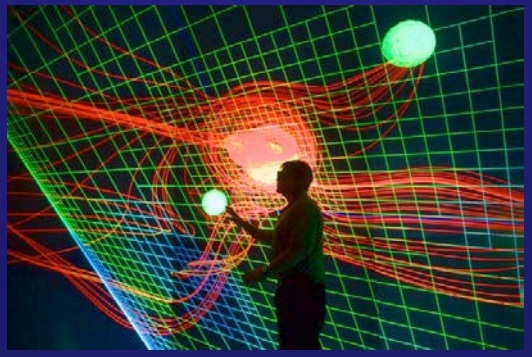
Numerical methods for multi-material compressible flow



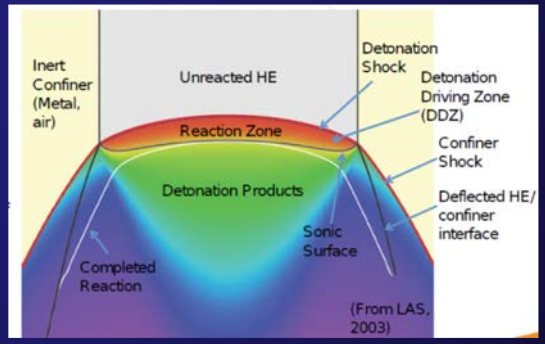
Inertial Confinement Fusion



High performance computing & visualization

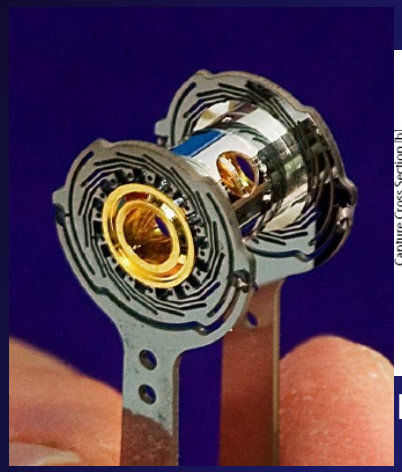


Reactive high explosives modeling

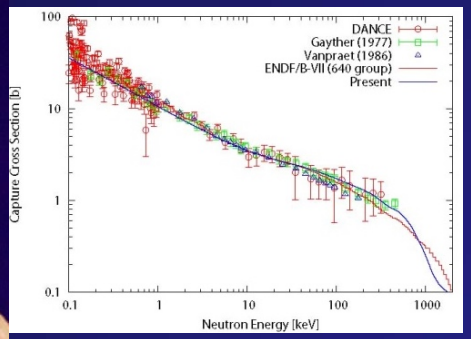


Los Alamos is the birthplace of computational physics

Opportunities in experimental science & engineering



High Energy Density (HED) Experiments

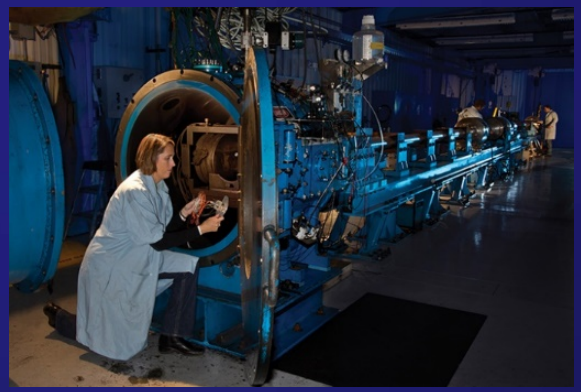


Nuclear Data Measurements

Extreme material dynamics

Precision laser measurements

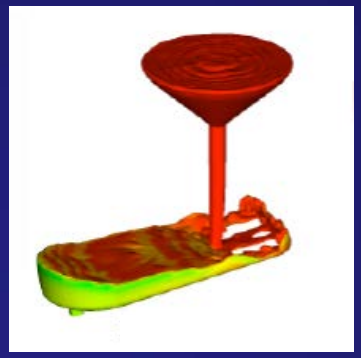
Shock environments



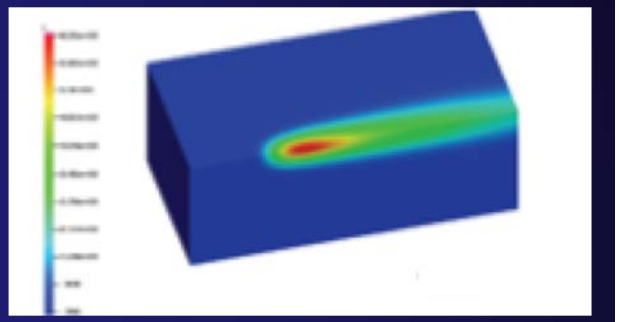
"It doesn't matter how beautiful your theory is, it doesn't matter how smart you are. If it doesn't agree with experiment, it's wrong."

Opportunities in manufacturing science & engineering

Plutonium casting and machining



Casting simulations



Additive manufacturing

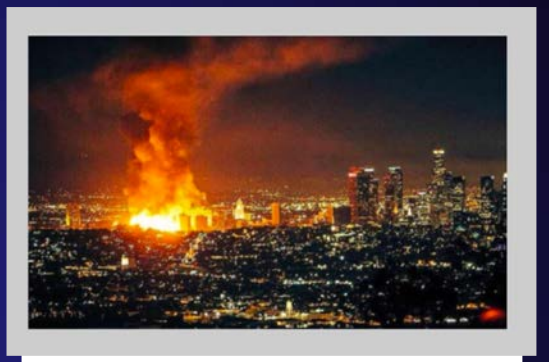
ChemCam laser

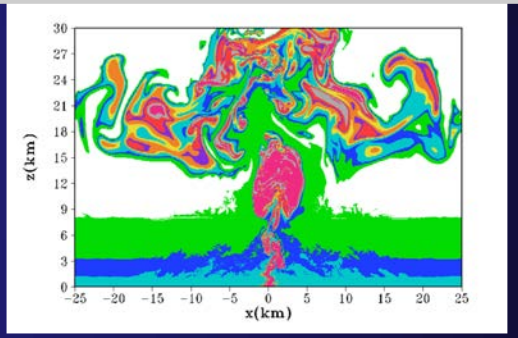
Pu-238 for radioisotope batteries

Contaminant removal

Opportunities supporting global nuclear security

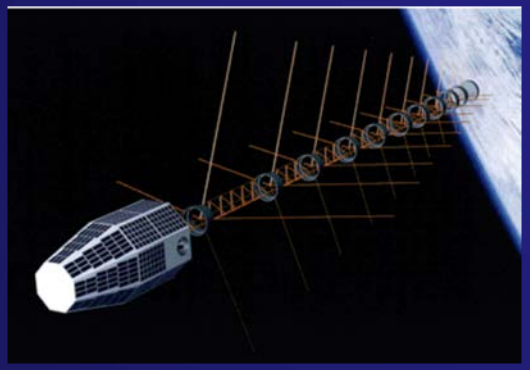
- Emerging global threats
- Nuclear nonproliferation
- Nuclear emergency response
- Weapons effects
- Nuclear forensics



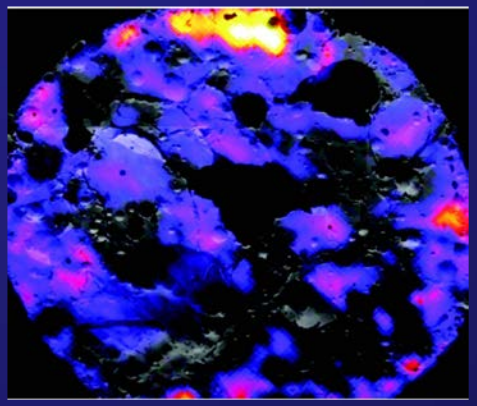


Fire growth and spread

Nuclear emergency response



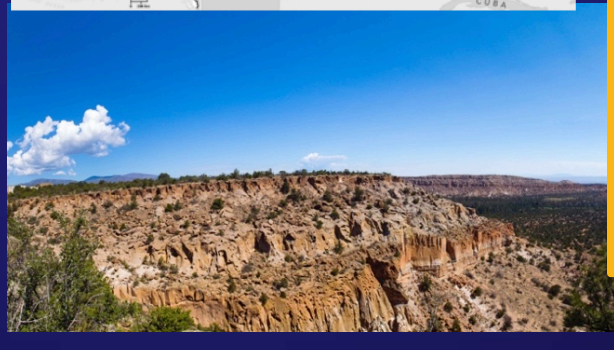
FORTE satellite to monitor for electromagnetic pulse events

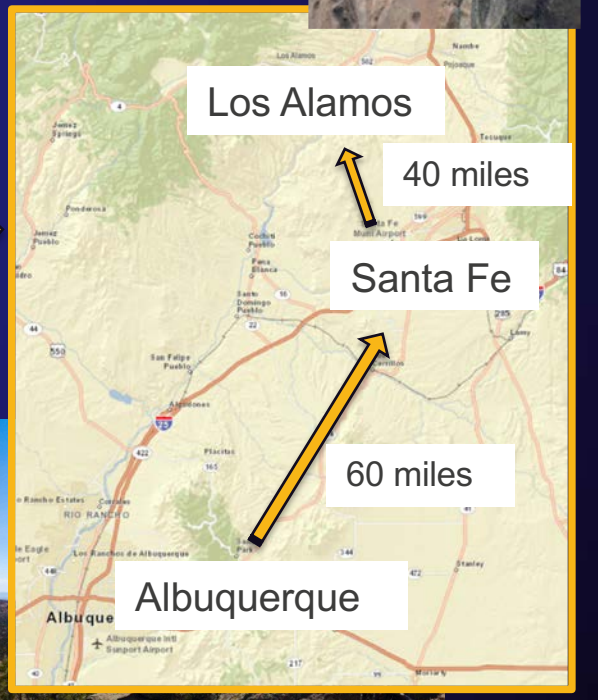


Digital radiograph of nuclear debris

Where we are: Northern New Mexico

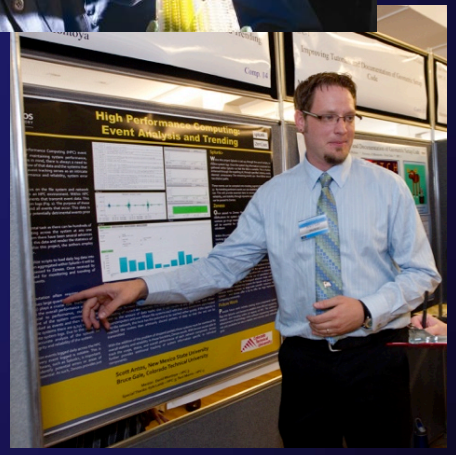
- 40 miles to Santa Fe, 100 miles to Albuquerque
- 7000 feet above sea level: Low pollution and four seasons
- Abundant outdoor activities in nearby mountains, mesas, forests, and rivers
- High quality of life with moderate cost of living
- Rich Spanish & Native American cultural history





Student and early-career opportunities

- Student Programs
  - Undergraduate internships in science & engineering:
    - Pay ranges from $13-$21/hr depending upon school progress
  - Post-Bachelor / Post-Masters:
    - Can be entry level or “gap year” between degree programs
    - Pay ranges from $23-$28/hr depending upon school progress
  - Post-Doctoral:
    - The most common entry level for PhD. Minimum pay $74k/yr
    - Some candidates may qualify for Distinguished Postdoc appointments that start at $108k
- Scientific & Engineering Staff
  - Permanent positions with pay depending upon degree and experience, often pipelined via one or more of the student programs
  - Often requires the ability to obtain a security clearance, which normally requires US citizenship
- We work hard to find opportunities for dual-career couples in science and engineering



Explore the opportunities for you at Los Alamos

lanl.jobs

or

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Research & photo credits

- Slide 6: RMI & reshock by Grinstein, et al.; ICF calcs by Haines, et al.; Compressible flow calcs by Burton, et al.
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